Architectural Testing

TEST REPORT

Rendered to:

LMT-Mercer Group, Inc.

For:

PRODUCT: 4x4 and 5x5 Structural Porch Post

Report No: 91272.01-119-16
Report Date: 06/01/09
Revision 1: 06/11/09

130 Derry Court
York, PA 17406-8405
phone: 717-764-7700
fax: 717-764-4129
www.archtest.com

Architectural Testing

TEST REPORT

91272.01-119-16
June 1, 2009
Revision 1: 06/11/09

TABLE OF CONTENTS

Architectural Testing

TEST REPORT

Rendered to:

LMT-MERCER GROUP, INC.
322 Lake Avenue
P.O. Box 1147
Hartville, Ohio 44632

Report No:	91272.01-119-16
Test Date:	05/05/09
Through:	05/18/09
Report Date:	06/01/09
Revision 1:	06/11/09

1.0 General Information

1.1 Product

4 x 4 and 5 x 5 Structural Porch Post

1.2 Project Description

Architectural Testing was contracted by LMT-Mercer Group, Inc. to evaluate the structural performance of their 4 x 4 and 5 x 5 structural porch posts in 108 in lengths. The evaluation was for concentric axial loads in compression, uplift loads, and tensile testing conducted on material specimens taken from the aluminum tube insert.

1.3 Product Description

All test samples were provided by the manufacturer for testing. Four columns of each size were provided for compression testing, and three for uplift resistance testing. The tensile samples were taken from 12 in sections of tested aluminum tube inserts from compression testing. The compression load samples measured a nominal 108 in long. The uplift samples measured a nominal 24 in long. Each sample was comprised of a molded PVC sleeve which surrounded an aluminum tube insert, four polypropylene filler strips, and two PVC mounting brackets.

2.0 Referenced Standards

ASTM E8 / E8M - 08, *Standard Test Methods for Tension Testing of Metallic Materials*

130 Derry Court
York, PA 17406-8405
phone: 717-764-7700
fax: 717-764-4129
www.archtest.com

3.0 Axial Load Compression Tests

3.1 Test Equipment

The test fixture consisted of a flat steel support attached to a rigid steel column at the top. The bottom consisted of a hydraulic jack positioned on a leveling fixture, fitted with a flat steel bearing plate and a 50,000 pound capacity load cell. Test duration, load, and deflection were recorded electronically throughout the test.

3.2 Test Setup

The columns were installed into the compression fixture with no physical connections between the column and fixture. The compression fixture was plumbed using a "PLS-5" laser plumbing device, and while applying a minimal preload to hold the test sample in place, the column was leveled with a 78 in level. An electronic linear displacement transducer was positioned at the mid-point of each of two axes on each column to measure lateral displacements about the X- and Y-Axes of the column. Reference photographs in Appendix B for test setup.

3.3 Test Procedure

Each test sample was inspected prior to testing to verify size and general condition of the materials, assembly, and installation. No potentially compromising defects were observed prior to the tests. Each test began with a small initial load and was loaded at a steady, uniform load rate until the test sample failed. Lateral displacements, test load, and time were electronically recorded throughout the test. The ultimate load and mode of failure were recorded for each test.

3.4 Axial Load Test Results

Test loads were concentric axial compression. X- and Y-Axis displacements were measured at the column's mid-height.

Specimen No. 1: 4x4 by 108 in Structural Porch Post
Test Date: 05/06/09

Test Load (lbs)	Displacement (in)	
	X	Y
0	-	-
2,762	0.00	0.00
4,016	0.065	0.018
5,017	0.131	0.042
6,050	0.205	0.068
7,013	0.271	0.084
8,043	0.352	0.102
9,066	0.476	0.122
10,020	0.601	0.141
11,123	0.877	0.187
11,321	Ultimate Load / Lateral Buckling	

Specimen No. 2: 4x4 by 108 in Structural Porch Post
Test Date: 05/06/09

Test Load (lbs)	Displacement (in)	
	X	Y
0	-	-
619	0.00	0.00
1,047	-0.004	-0.062
2,016	0.046	-0.142
3,216	0.142	-0.173
4,112	0.220	-0.186
5,057	0.293	-0.201
6,011	0.343	-0.222
7,017	0.391	-0.253
8,019	0.445	-0.293
9,012	0.506	-0.336
10,088	0.615	-0.397
11,033	0.784	-0.477
11,622	Ultimate Load / Lateral Buckling	

3.4 Axial Load Test Results (Continued)

Specimen No. 3: 4x4 by 108 in Structural Porch Post
Test Date: 05/06/09

Test Load (lbs)	Displacement (in)	
	X	Y
0	-	-
1000	0.00	0.00
2053	0.055	-0.010
3091	0.087	-0.026
4049	0.116	-0.043
5170	0.146	-0.070
6001	0.171	-0.092
7011	0.205	-0.109
8154	0.256	-0.139
9057	0.312	-0.171
10042	0.403	-0.220
11062	0.533	-0.289
11,924	Ultimate Load / Lateral Buckling	

Specimen No. 4: 4x4 by 108 in Structural Porch Post
Test Date: 05/06/09

Test Load (lbs)	Displacement (in)	
	X	Y
0	-	-
1,522	0.00	0.00
2,021	0.015	-0.044
3,030	0.093	-0.135
4,145	0.138	-0.194
5,115	0.166	-0.229
6,209	0.193	-0.278
7,260	0.217	-0.322
8,031	0.248	-0.377
9,047	0.296	-0.459
10,002	0.360	-0.556
11,036	0.533	-0.721
11,529	Ultimate Load / Lateral Buckling	

3.4 Axial Load Test Results (Continued)

Specimen No. 1: 5x5 by 108 in Structural Porch Post
Test Date: 05/06/09

Test Load (lbs)	Displacement (in)	
	X	Y
0	-	-
124	0.000	0.000
1,414	0.177	-0.047
2,087	0.251	-0.072
3,102	0.302	-0.090
4,138	0.324	-0.097
5,150	0.339	-0.103
6,007	0.358	-0.121
7,055	0.385	-0.152
8,020	0.403	-0.160
9,022	0.422	-0.168
10,031	0.440	-0.175
11,037	0.456	-0.183
12,064	0.474	-0.191
13,131	0.500	-0.199
14,087	0.524	-0.207
15,014	0.559	-0.219
16,158	0.606	-0.235
17,048	0.666	-0.251
18,015	0.764	-0.280
18,491	Ultimate Load / Lateral Buckling	

3.4 Axial Load Test Results (Continued)

Specimen No. 2: 5x5 by 108 in Structural Porch Post
Test Date: 05/06/09

Test Load (lbs)	Displacement (in)	
	X	Y
0	-	-
205	0.000	0.000
1,166	0.050	-0.043
2,004	0.178	-0.107
3,107	0.238	-0.131
4,067	0.269	-0.140
5,129	0.289	-0.148
6,101	0.305	-0.157
7,017	0.314	-0.167
8,035	0.334	-0.175
9,109	0.364	-0.184
10,012	0.386	-0.188
11,079	0.413	-0.192
12,058	0.435	-0.197
13,025	0.463	-0.203
14,000	0.493	-0.215
15,107	0.531	-0.229
16,011	0.579	-0.253
17,045	0.641	-0.304
18,120	0.775	-0.352
18,573	Ultimate Load / Lateral Buckling	

3.4 Axial Load Test Results (Continued)

Specimen No. 3: 5x5 by 108 in Structural Porch Post
Test Date: 05/06/09

Test Load (lbs)	Displacement (in)	
	X	Y
0	-	-
749	0.000	0.000
1,961	0.024	-0.013
2,839	0.153	-0.020
3,279	0.184	-0.021
4,199	0.217	-0.024
5,056	0.225	-0.032
6,223	0.241	-0.044
7,431	0.124	-0.053
8,578	0.100	-0.062
9,088	0.513	-0.041
10,384	0.533	-0.045
11,338	0.551	-0.044
12,141	0.567	-0.044
13,008	0.610	-0.051
14,503	0.640	-0.063
15,154	0.669	-0.076
16,235	0.709	-0.091
17,137	0.780	-0.116
18,255	0.886	-0.135
18,717	Ultimate Load / Lateral Buckling	

3.4 Axial Load Test Results (Continued)

Specimen No. 4: 5x5 by 108 in Structural Porch Post
Test Date: 05/06/09

Test Load (lbs)	Displacement (in)	
	X	Y
0	-	-
143	0.000	0.000
895	0.000	-0.004
2,238	0.163	-0.046
3,391	0.277	-0.039
4,098	0.324	-0.037
5,470	0.349	-0.038
6,507	0.357	-0.045
7,555	0.370	-0.050
8,531	0.379	-0.062
9,584	0.397	-0.080
10,051	0.416	-0.096
11,066	0.439	-0.121
12,172	0.463	-0.146
13,086	0.485	-0.164
15,564	0.525	-0.202
15,572	0.557	-0.233
16,366	0.596	-0.269
17,333	0.647	-0.306
18,098	0.762	-0.365
18,215	Ultimate Load / Lateral Buckling	

3.5 Test Summary

Results are ultimate load capacity of individual specimens and should not be used as safe working values or design load values.

4x4 by 108 in Structural Porch Post
Test Date: 05/06/09

Specimen No.	Ultimate Load (lbs)	Percent Deviation From Average
1	11,321	2%
2	11,622	0%
3	11,924	3%
4	11,529	1%
Minimum:	11,321	
Maximum:	11,924	
Average:	**11,599**	

5x5 by 108 in Structural Porch Post
Test Date: 05/06/09

Specimen No.	Ultimate Load (lbs)	Percent Deviation From Average
1	18,491	0%
2	18,573	0%
3	18,717	1%
4	18,215	2%
Minimum:	18,215	
Maximum:	18,717	
Average:	**18,499**	

4.0 Uplift Load Tests

4.1 Test Equipment

The specimens were tested to ultimate capacity in tension utilizing a SATEC Unidrive, Model MII 50 UD, Universal Test Machine.

4.2 Test Setup

The testing machine was fitted with pressure treated Southern Yellow Pine (SYP) 2x8 at the top and bottom to accommodate anchorage of the post mounts. The mounting brackets were secured to the 2x8 with four #10 x 1-1/2 in self-starting screws. Each mounting bracket attached to the aluminum insert with four #10 x 3/4 in self-starting screws, and the PVC sleeve was attached to each mounting bracket with two #10 x 3/4 in self-starting screws. Tests were conducted at lab ambient temperature (68ºF ± 4ºF). Reference photographs in Appendix B for test setup.

4.3 Test Procedure

After securing each column into the test machine, the load was applied at a uniform rate of 0.05 in/min. until failure. The test duration, ultimate test load, and mode of failure were recorded for each test.

4.4 Uplift Load Test Results

Results are ultimate load capacity of individual specimens and should not be used as safe working values or design load values.

4x4 by 108 in Structural Porch Post
Test Date: 05/18/09

Specimen No.	Ultimate Load (lbs)	% Deviation From Average	Failure Mode
1	1211	5%	Mounting bracket fracture
2	1047	10%	Mounting bracket fracture
3	1199	4%	Mounting bracket fracture
Average:	**1,152**		

5x5 by 108 in Structural Porch Post
Test Date: 05/18/09

Specimen No.	Ultimate Load (lbs)	% Deviation From Average	Failure Mode
1	1150	3 %	Mounting bracket fracture
2	1020	9%	Mounting bracket fracture
3	1180	5%	Mounting bracket fracture
Average:	**1,117**		

Reference photographs in Appendix B for mode of failure.

5.0 Tensile Test of Aluminum Coupons

Re: ASTM E 8 / E8M - 08

5.1 General

The purpose of this testing was to confirm the tensile strength of the aluminum material used in the structural porch posts. The aluminum used was specified by LMT-Mercer Group, Inc. as 6005-T5. The typical yield strength of 6005-T5 is 38 ksi with a typical ultimate tensile strength of 42 ksi.

5.2 Test Specimens

Tensile test specimens were machined from aluminum tube used in the axial compression tests. Specimen size was per FIG 13 of ASTM E8 / E8M - 08 for large-diameter tubular products. Reference photographs in Appendix B.

5.3 Test Procedure

The specimens were tested using a SATEC Unidrive, Model MII 50 UD, Universal Test Machine with SATEC "T" grips and operating at a uniform cross-head speed of 0.2 in/min. Strain was measured using a SATEC Model T1M snap-on Extensometer with a 2 in gage length. Reference photographs in Appendix B.

5.4 Test Results

4x4 by 108 in Structural Porch Post
Test Date: 05/20/09

Specimen ID and No.	Width (in)	Thickness (in)	Modulus of Elasticity (10^6 psi)	Yield Strength (10^3 psi)	Tensile Strength (10^3 psi)	Elongation (%)
1	0.499	0.099	9547500	36557	40580	6.6
2	0.500	0.099	9420200	36672	40141	10.0
3	0.502	0.100	9173800	33873	38022	10.5
4	0.502	0.100	8856500	33770	38928	11.5
5	0.501	0.101	8978900	36384	39985	10.3
Average:	0.501	0.100	9195400	35451	39531	9.8
Standard Deviation:	0.001	0.001	290100	1492	1039	1.9
Coefficient of Variation:	0.3%	0.8%	3.2%	4.2%	2.6%	19.1%

5.4 Test Results (Continued)

5x5 by 108 in Structural Porch Post
Test Date: 05/20/09

Specimen ID and No.	Width (in)	Thickness (in)	Modulus of Elasticity (10^6 psi)	Yield Strength (10^3 psi)	Tensile Strength (10^3 psi)	Elongation (%)
1	0.502	0.082	8504200	35988	39258	10.2
2	0.502	0.078	9567900	36230	39532	11.9
3	0.502	0.078	8086000	35253	38076	2.0
4	0.502	0.082	15470500	36482	39369	11.0
5	0.500	0.084	8986400	35461	38896	10.0
Average:	0.502	0.081	10123000	35883	39026	9.0
Standard Deviation:	0.001	0.003	3040000	516	580	4.0
Coefficient of Variation:	0.2%	3.3%	30.0%	1.4%	1.5%	44.3%

5.5 Test Summary

The average yield strength was determined to be approximately 36 ksi and the average tensile strength was 39 ksi. Both of these values were less than the typical yield and tensile strength of 6005-T5 aluminum. Therefore, no adjustment due to the aluminum strength was required.

6.0 Closing Statement

Detailed drawings, data sheets, representative samples of test specimens, a copy of this test report, and all other supporting evidence will be retained by Architectural Testing for a period of four years from the original test date. At the end of this retention period, said materials shall be discarded without notice, and the service life of this report by Architectural Testing shall expire. Results obtained are tested values and were secured using the designated test methods. This report neither constitutes certification of this product nor expresses an opinion or endorsement by this laboratory; it is the exclusive property of the client so named herein and relates only to the tested specimens. This report may not be reproduced, except in full, without the written approval of Architectural Testing.

For ARCHITECTURAL TESTING:

Digitally Signed by: Keith A. Gurnee

Keith A Gurnee
Technician II
Structural Systems Testing

Digitally Signed by: Evan D. Laub

Evan D. Laub, E.I.T.
Project Engineer
Structural Systems Testing

KAG:kag/alb

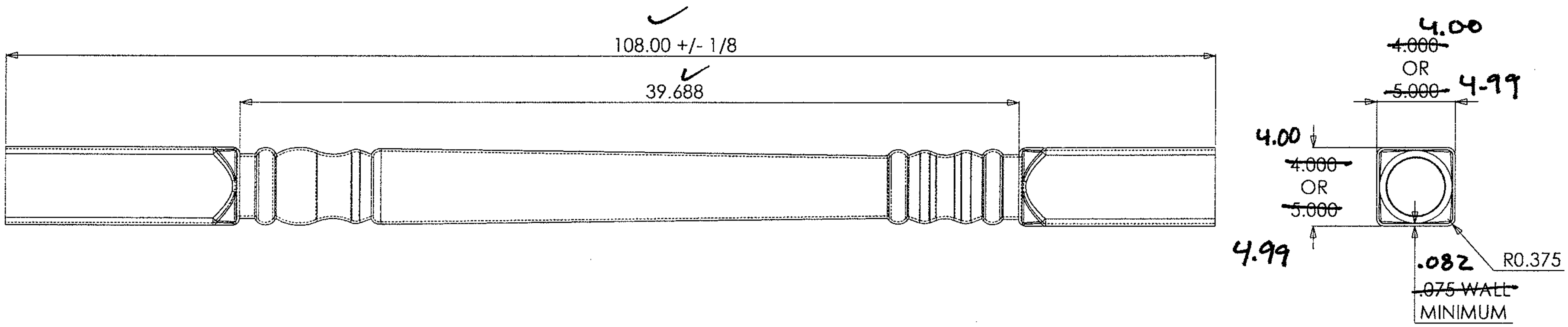
Attachments (pages): This report is complete only when all attachments listed are included.
Appendix A: Drawings / Installation Instructions (8)
Appendix B: Photographs (6)

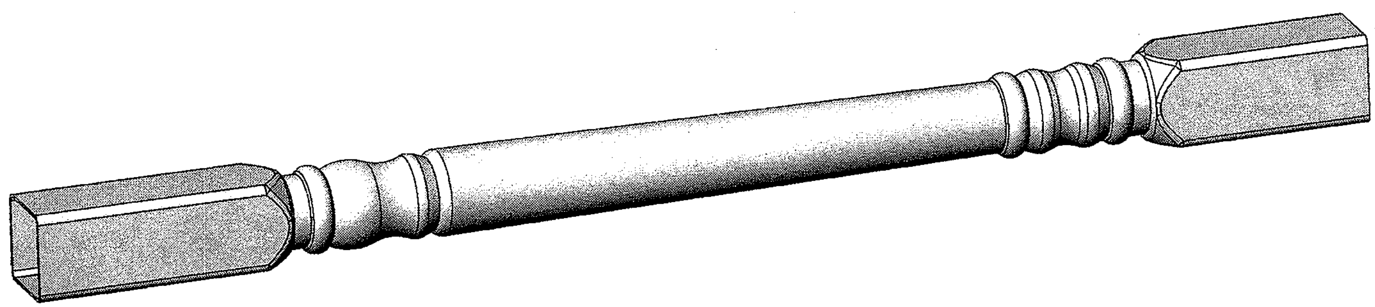
Revision Log

Rev. #	Date	Page(s)	Revision(s)
0	06/01/09	N/A	Original report issue
1	06/11/09	1	In last sentence of Section 1.3 corrected material type; changed PVC to polypropylene

APPENDIX A

Drawings / Installation Instructions





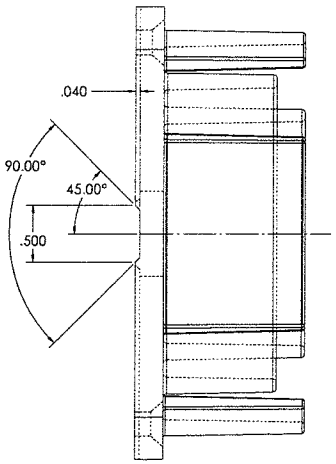
Architectural Testing

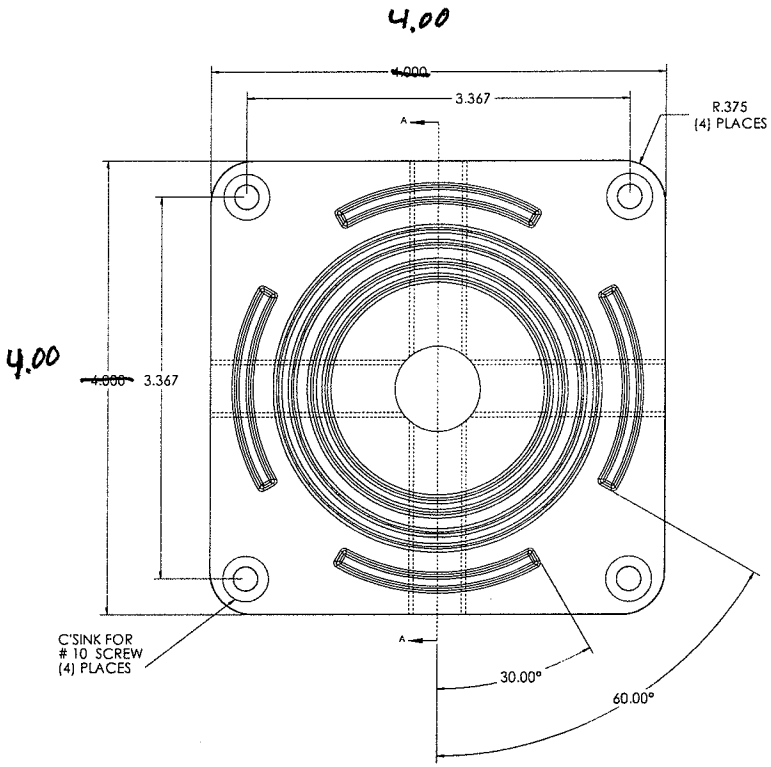
Test sample complies with these details.
Deviations are noted.

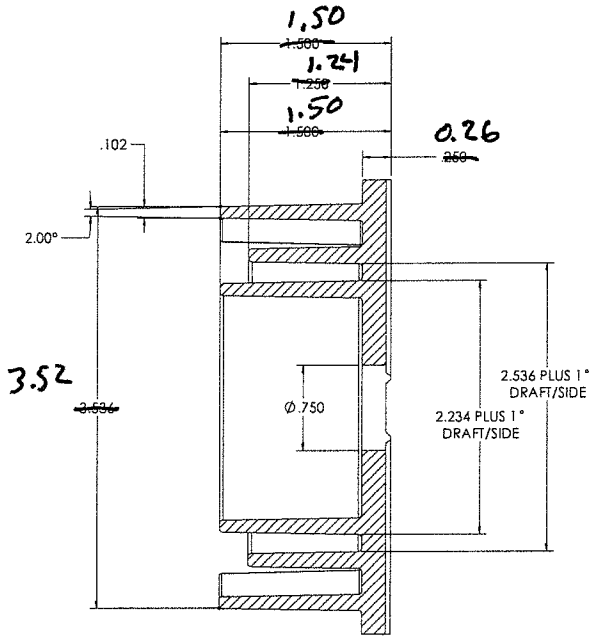
Report# 91272.01-119-16

Date 05-26-09 **Tech** KAG

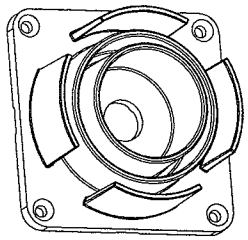
TOLERANCES UNLESS SPECIFIED		**LMT-MERCER GROUP**	REV
FRACTIONAL	± 1/64	LMT-MERCER GROUP INC. 690 PURITAN AVENUE LAWRENCEVILLE, NJ 08648	A
ANGULAR	± 1/2°		
.XX	± .02		
.XXX	± .005	SHEET DESCRIPTION:	
.XXXX	± .001	PORCH POST	
DESIGN: F LOFTUS		CUSTOMER: LMT PART NUMBER:	
APPROVED:	MM/DD/YY		
RELEASE DATE: MM/DD/YY		SCALE: 1:25 MATERIAL: PVC SHRINKAGE: N/A	SHEET 1 OF 1







SECTION A-A



ISOMETRIC SCALE: 1:1

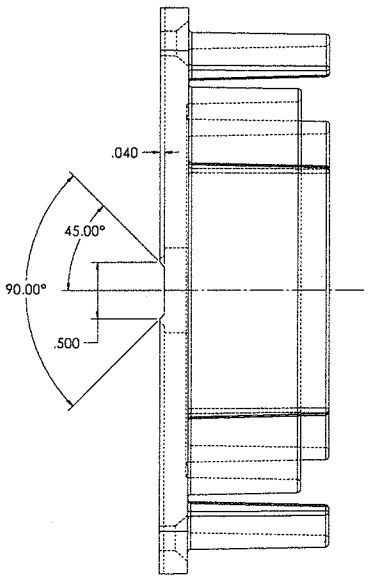
Architectural Testing

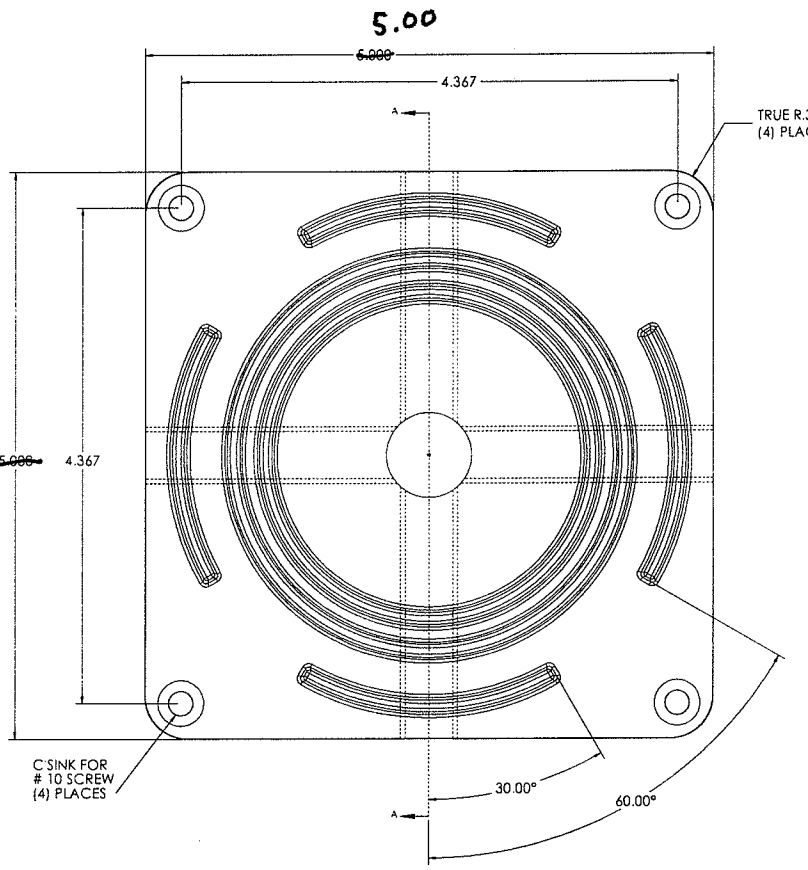
Test sample complies with these details.
Deviations are noted.

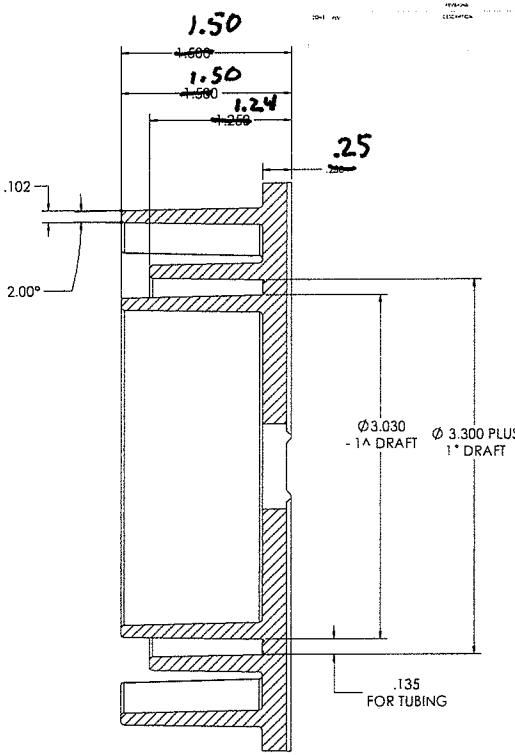
Report# 91272.01-119-16

Date 05-26-09 **Tech** KAG

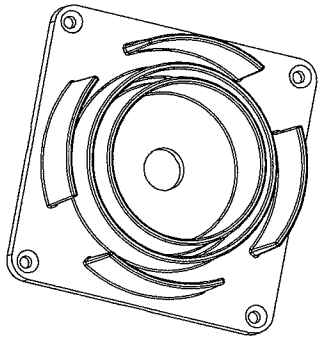
TOLERANCES UNLESS SPECIFIED		**LMT-MERCER GROUP**			REV
FRACTIONAL	± 1/64	LMT-MERCER GROUP INC.			A
ANGULAR	± 1/2°	490 PARKAM AVENUE			
.XX	± .02	LAWRENCEVILLE, NJ 08648			
.XXX	± .005	PURCHASE/UNE: 4 INCH			
.XXXX	± .001				
DESIGN: W. FORD		CUSTOMER: LMT			
APPROVED:		PART NUMBER:			
RELEASE DATE: MM/DD/YY		SCALE: 2:1	MATERIAL: PVC	SHRINKAGE: N/A	SHEET 1 OF 1







SECTION A-A



ISOMETRIC SCALE 1:1

Architectural Testing

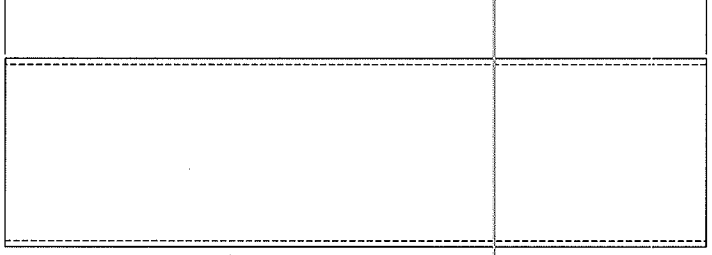
Test sample complies with these details.
Deviations are noted.

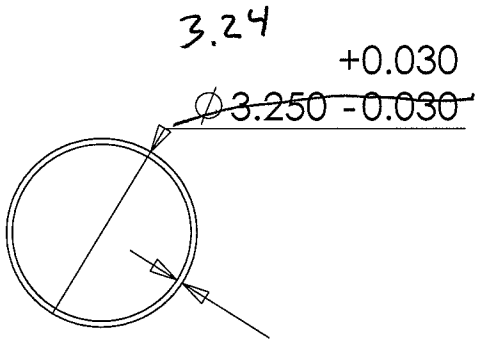
Report# 91272.01-119-16

Date 05-26-09 Tech KAG

TOLERANCES UNLESS SPECIFIED		**LMT-MERCER GROUP**	REV
FRACTIONAL	± 1/64	LMT-MERCER GROUP INC.	A
ANGULAR	± 1/2°	690 PURITAN AVENUE	
.XX	± .02	LAWRENCEVILLE, NJ 08648	
.XXX	± .005	PORCH MOUNT, 5 INCH	
.XXXX	± .001		
DESIGN: W. FORD		CUSTOMER: LMT	
APPROVED:		PART NUMBER:	
RELEASE DATE: MM/DD/YY		SCALE: 2:1 MATERIAL: PVC SHRINKAGE: N/A SHEET 1 OF 1	

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED





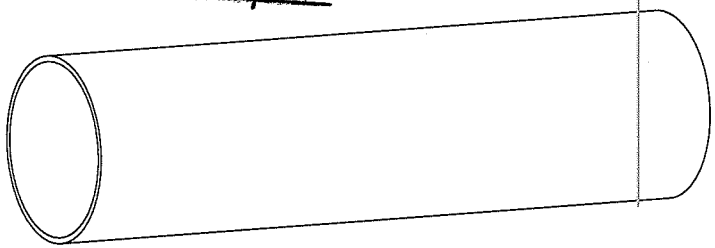
Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report# 91272.01-119-16

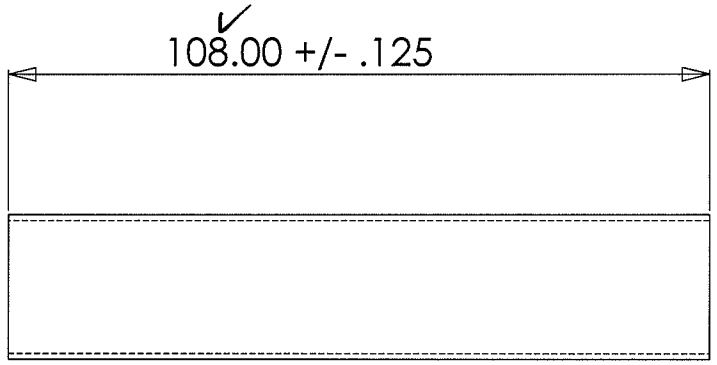
Date 05-26-09 Tech KAG

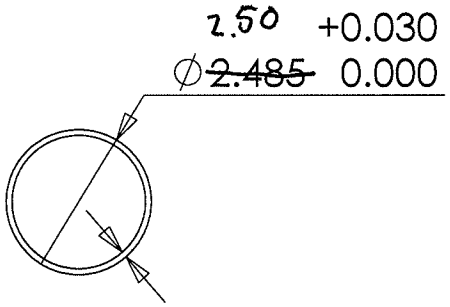
MATERIAL : 6005 T5 ALUMINUM



TOLERANCES UNLESS SPECIFIED FRACTIONAL ± 1/64 ANGULAR ± 1/2° .XX ± .010 .XXX ± .002 .XXXX ± .0005	**LMT-MERCER GROUP** LMT-MERCER GROUP INC. 690 PURITAN AVENUE LAWRENCEVILLE, NJ 08648				REV A
	SHEET DESCRIPTION: 5 PORCH POST ALUM TUBE			THIRD ANGLE PROJECTION	
DESIGN: F.LOFTUS 2/10/09	CUSTOMER: LMT PART NUMBER: 25515				
APPROVED: J. FATTORI 3/1/09					
RELEASE DATE: 3/1/09	SCALE: 1=2	MAT: SEE NOTE	SHRINKAGE: N/A	SHEET 1 OF 1	

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED



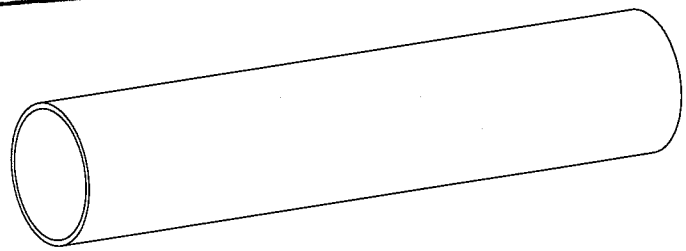


Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report# 91272.01-119-16

Date 05-26-09 Tech KAG



MATERIAL : 6005 T5 ALUMINUM

TOLERANCES UNLESS SPECIFIED	
FRACTIONAL	± 1/64
ANGULAR	± 1/2°
.XX	± .010
.XXX	± .002
.XXXX	± .0005

LMT-MERCER GROUP

LMT-MERCER GROUP INC.
690 PURITAN AVENUE
LAWRENCEVILLE, NJ 08648

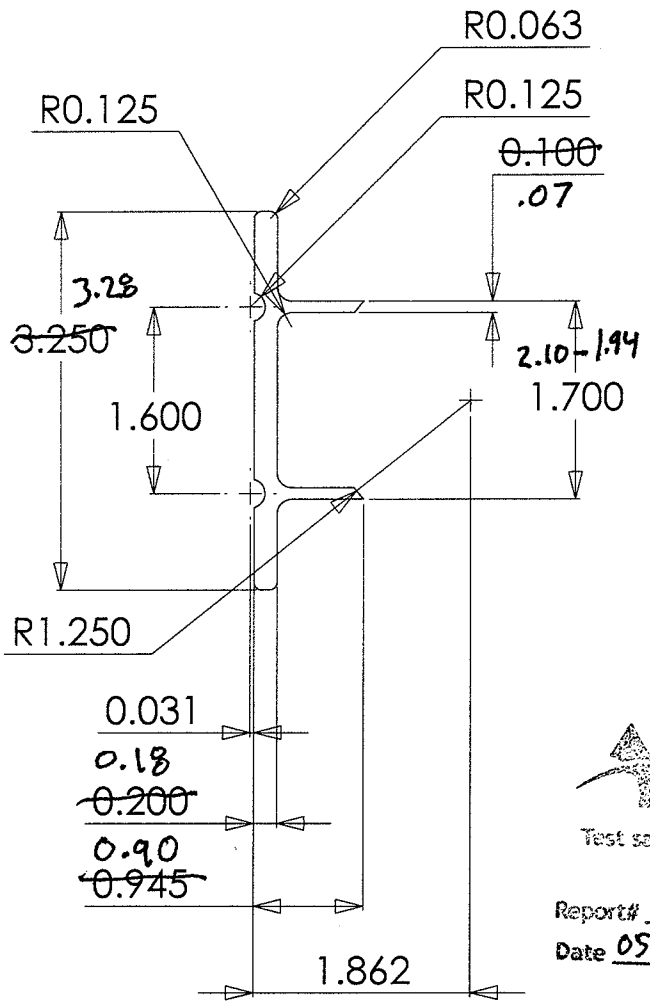
REV A

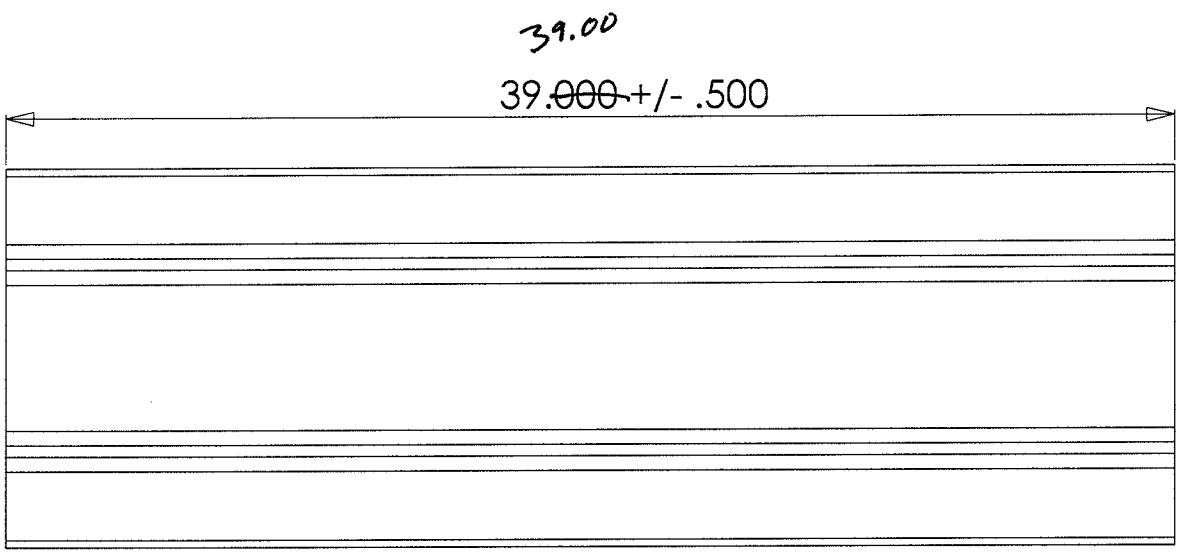
SHEET DESCRIPTION:
4 PORCH POST ALUM TUBE

THIRD ANGLE PROJECTION

DESIGN: F.LOFTUS	2/10/09	CUSTOMER: LMT PART NUMBER: 25535			
APPROVED: J. FATTORI	3/1/09				
RELEASE DATE: 3/1/09		SCALE: 1=2	MAT: SEE NOTE	SHRINKAGE: N/A	SHEET 1 OF 1

REVISIONS			
ZONE	REV	DESCRIPTION	DATE	APPROVED





Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report# 91272.01-119-16

Date 05-26-09 Tech KAG

TOLERANCES UNLESS SPECIFIED
FRACTIONAL ± 1/64
ANGULAR ± 1/2°
.XX ± .010
.XXX ± .002
.XXXX ± .0005

DESIGN: F.LOFTUS 3/22/09

APPROVED: MM/DD/YY

RELEASE DATE: MM/DD/YY

LMT-MERCER GROUP

LMT-MERCER GROUP INC.
690 PURITAN AVENUE
LAWRENCEVILLE, NJ 08648

REV A

SHEET DESCRIPTION:
FILLER STRIP

THIRD ANGLE PROJECTION

CUSTOMER: LMT
PART NUMBER:

SCALE: 1=1 MATERIAL: PVC SHRINKAGE: N/A SHEET 1 OF 1

Mercer Group, Inc.

INSTALLATION INSTRUCTIONS
4x4 and 5x5
STRUCTURAL PORCH POST

TOOLS REQUIRED:

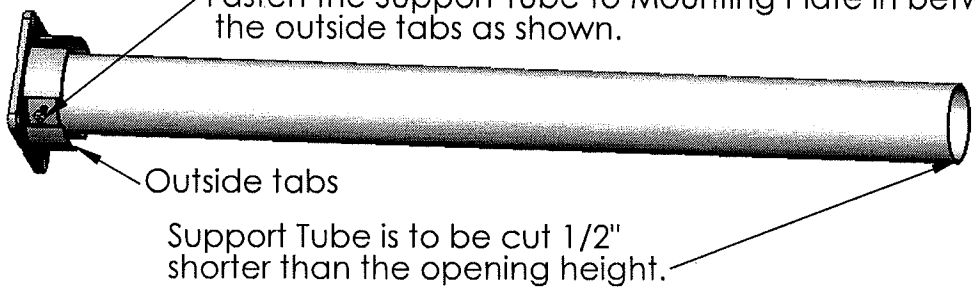
- Chop/Mitre Saw with carbide tipped blade
- Tape measure
- Pencil
-Drill and drill bits
-Level

HELPFUL HINTS:

- DO NOT LAY VINYL PARTS ON ABRASIVE SURFACE S
- 1/8" Tapcon anchors are recommended for installation on concrete.(Not provided.)
- Use a carbide-tipped multi-purpose blade.
- If any components are missing or defective, please call us at 888-570-5252

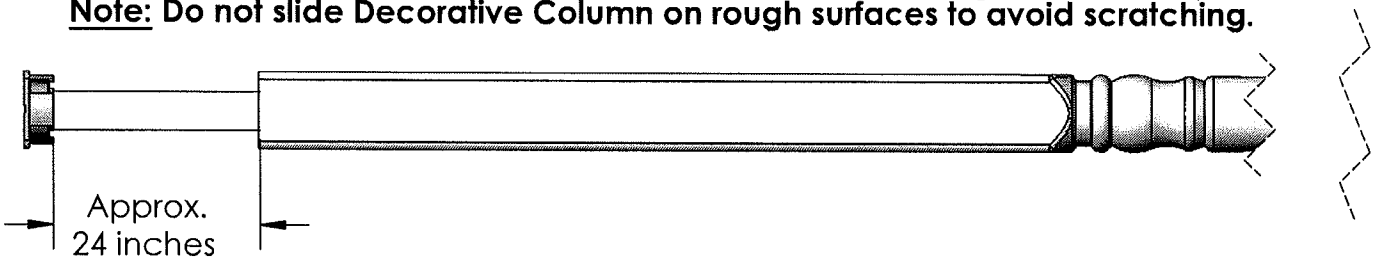
1 Measure the opening height and cut the Aluminum Support Tube 1/2" shorter than that height.

1 Insert the Aluminum Support Tube into the Mounting Plate and fasten it together using the (4) #10 x 3/4" screws provided.

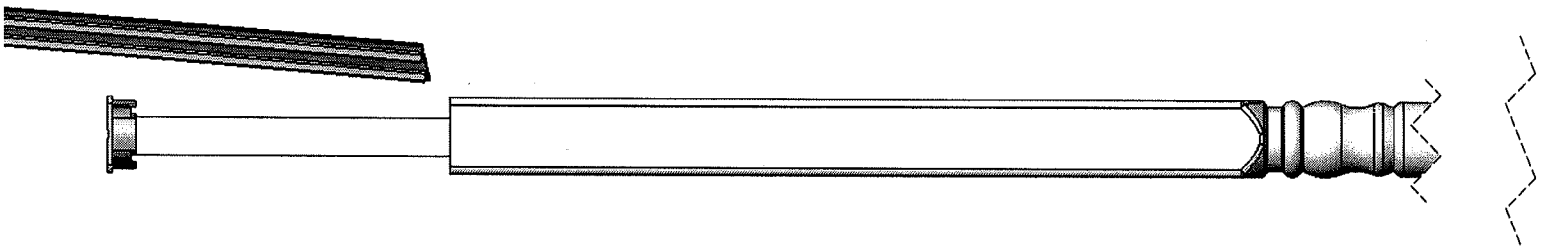


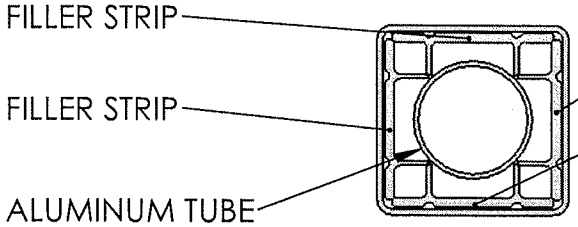
3) Cut the Molded Decorative Column 1-1/4" shorter than the opening height.

4) Slide the Decorative Column over the Support Tube leaving about 24" exposed.
Note: Do not slide Decorative Column on rough surfaces to avoid scratching.



5) Slide a filler strip into each side of the Decorative Column in between The Aluminum Support Tube and the inside wall of the Column. Do this on all 4 sides.





Proper Filler Strip Installation

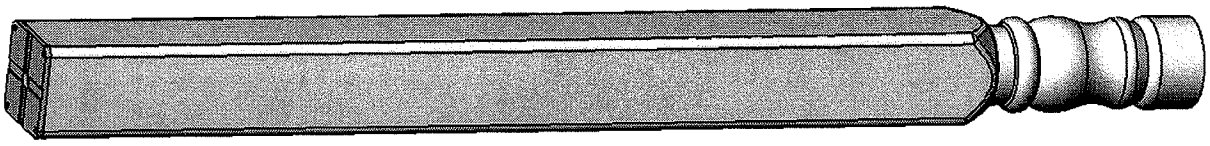
Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report# 91272.01.-119-16

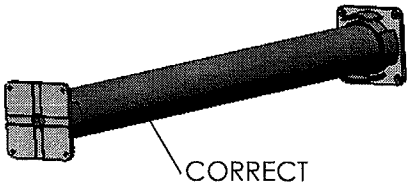
Date 5/29/09 Tech EDL

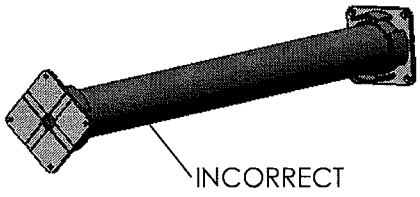
6) Slide the Decorative Column over the Filler Strips and down onto the Mounting Plate until they sit flush as shown.



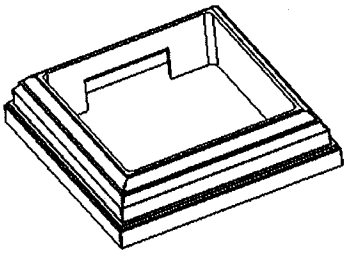
7) Place the second supplied Mounting Plate on the top of the Aluminum Support Tube And fasten it using the supplied (4) #10 x 3/4" screws provided. See step 2 for the proper location of these screws.

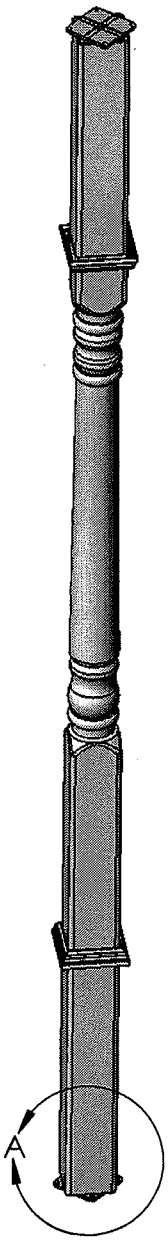
Note: The sides of the two Mounting Plates must be parallel to each other as shown below. The Decorative Post has been removed for clarity.





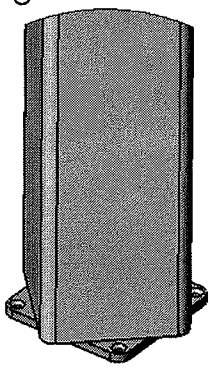
8) Cut out a notch on the inner wall of the (2) Post Skirts as show. This will be required to clear for screw heads installed in a later step.





9) Slide (2) Post Skirts (Not provided) onto the Decorative Column and place the entire assembly into the opening in the desired location.

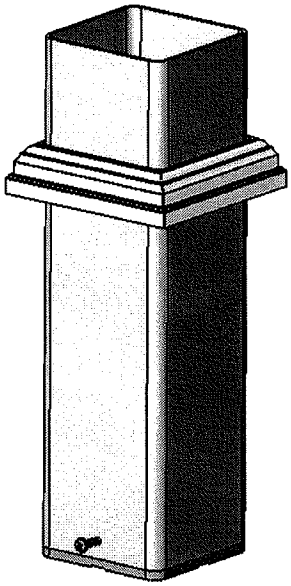
10) Rotate the Decorative Column 45 degrees to expose the mounting holes in the Mounting Plates.



11) Fasten the Mounting Plates to the floor and ceiling using the appropriate fasteners (Not provided) for your application. Insure that the post is plumb and square.

12) Rotate the Decorative Column back to its correct position and attach it to the mounting plates on both the top and bottom using the (2) #10 x 3/4 screws provided.

Note: These screws need to be placed on the sides of the post that has the notches on the Post Skirts.



13) Slide the Post Skirts into their positions on the top and bottom of the post and affix using PVC glue.

Architectural Testing

Test sample complies with these details.
Deviations are noted.

Report# 91272.01-119-16

Date 5/29/09 Tech EDL

APPENDIX B

Photographs

Photo No. 1
Column Base with Hydraulic Jack and Load Cell

Photo No. 2
Axial Load Test Set-Up (4x4 Structural Porch Post)

Photo No. 3
Axial Load Test Typical Buckling Failure of Specimen
(4x4 Structural Porch Post)

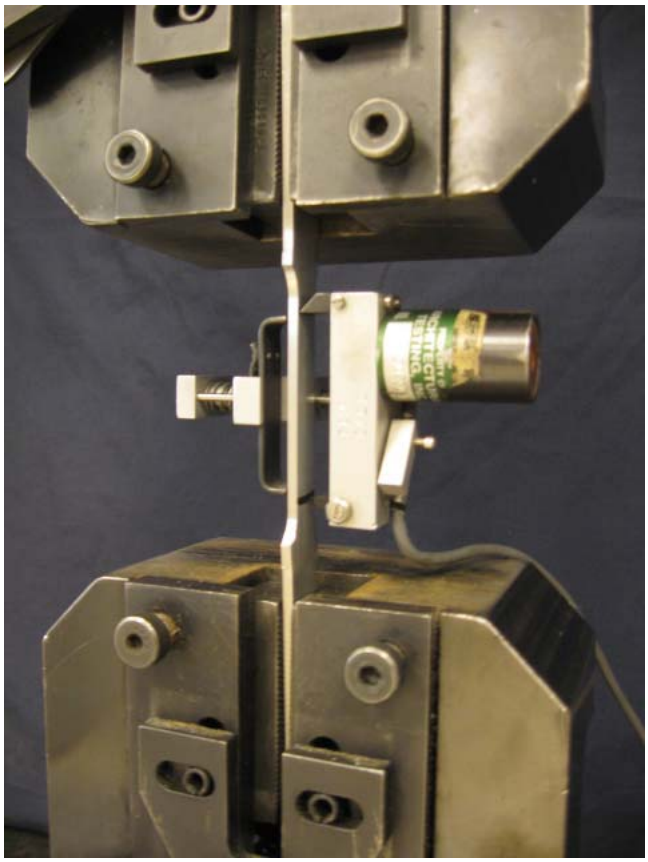


Photo No. 4
Tensile Load Test Setup (Aluminum Tube Coupon)

Photo No. 5
Uplift Load Test Setup

Photo No. 6
Uplift Load Test - Typical Mounting Bracket Fracture

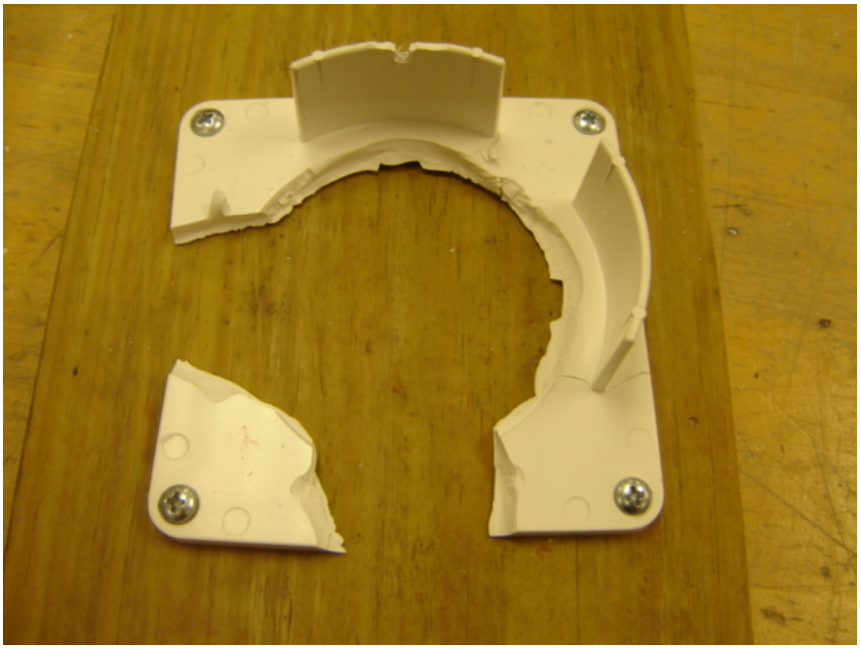


Photo No. 7
Uplift Load Test - Typical Mounting Bracket Fracture